IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Joel Kindem et al Art Unit: 2884
Serial No: 10/776,645 Examiner: Shun K. Lee
Filed : February 10, 2004
TITLE: SCINTILLATOR ASSEMBLY WITH PRE-FORMED REFLECTOR

Applicant's brief on appeal

Applicant herewith resubmits this appeal brief, as originally filed August 18, 2008, thereby perfecting the notice of appeal originally filed under 37 CFR 41.31 on May 16, 2008. The rule 41.20(b)(2) fee (small entity) was previously filed.

The sections required by 37 CFR 41.37 follow.

Real party in interest

Digirad Corporation is the 100% assignee of this application and hence is the real party in interest.

Related appeals and interferences

There are no known related appeals and/or interferences.

Status of claims

Claims 1-7, 9, 11-14, 16-26, 29 and 32-52 are pending.

Claims 8, 10, 15, 27, 28, 30, 31 have been cancelled.

Claims 1-7, 9, 11-14, 16-26, 29 and 32-52 are all rejected.

Each of claims 1-7, 9, 11-14, 16-26, 29 and 32-52 are appealed herein.

Status of amendments

An amendment enter final was filed on April 16, 2008, and was denied entry in an advisory action dated April 23, 2008, based on the allegation of new matter and new issues.

Accordingly, the claims being appealed are those as they existed prior to that April 16, 2008 amendment.

Summary of claimed subject matter

Claim 1 defines an array of scintillator material that has plural pixels of separated material and a bridge of uncut material holding together the plural pixels in a specified geometry. Figure 1A shows this array of material holding together in the specified geometry. For example, page 17 of the specification paragraph 27 lines 12-14 explains that the exit window bridge 205 spans the gaps between the pixel(s) 202.

Claim 1 also defines a preformed reflector formed of polyethylene with titanium dioxide having surfaces that mate with the reflector. Paragraph 27 describes the reflector 203 and Paragraph 48 describes polyethylene as the material that is used to form the reflector 203 in figure 1a. Paragraph 49 page 28 lines 7-10 describe using titanium dioxide as an additive. This is also described as being used to form a subassembly that mates with the subassemblies; that have exit window bridges to form the scintillator assemblies. Hence this subject matter, page 28 lines 17-20 explains and supports the subject matter of claim 1 where the bridge 205 has specified surfaces that hold it partly within the reflector 203. See figure 1a.

Claim 9 defines the scintillator assembly having outer surfaces of a first shape. See for example, the scintillator array 201 formed of scintillator pixels 202, described on page

17 of the specification line 5 and shown in Fgure 1a. Claim 9 also defines a preformed reflector that has surfaces that mate with the first shape to contain the scintillator material, see reflector 203 described page 17 line 6 and shown in Figure 1A. Claim 9 also defines the reflector formed to leave an air gap with a protrusion that forms the air gap. See page 23 lines 12-15 that describes ribs or other protrusions molded into walls to form the air gap, and Figure 2c.

Claim 16 defines an array of scintillator material with plural pixels and a bridge holding those arrays together. See page 17 of the specification lines 12-14 and Figure 1a. Claim 16 defines a preformed reflector of polyethylene with plural inner surfaces that hold the material therein. See for example, the scintillator array 201 formed of scintillator pixels 202, described on page 17 of the specification line 5 and shown in Figure 1a. Claim 16 also defines that one of the pixels comprises one material differing from another material of another pixels. See paragraph 32 page 19 lines 15-16, which describes that the elements of the scintillator array "can be formed … of multiple different materials".

Claim 37 defines preforming a reflector array with individual pixels from polyurethane. See for example, the scintillator array 201 formed of scintillator pixels 202,

described on page 17 of the specification line 5 and shown in Figure 1a. See also the description of polyurethane in paragraph 48 of the specification. Claim 37 also requires attaching the reflector to an array of scintillator material of separated pixels that define a two-dimensional array held together by a bridging portion. See page 17 lines 12-14 that describes the pixels 202 and a bridging portion 205 and Figure 1a. These are shown in a two-dimensional array. The attaching comprises holding the two-dimensional array using the bridging portion. See for example page 17 lines 10-16.

Claim 44 defines preforming a reflector of a specified shape with a tapered part tapered in two different directions. See paragraph 34, page 20 lines 5-15 which shows the tapered end section 331 in Figure 2a. Claim 44 also defines attaching the reflector 301, 302 to a scintillator material that mates within and held in place by the surfaces thereof.

See generally paragraph 34 and 35 that describes the scintillator with material to hold that material in place. See page 20, last 4 lines that describes a press fit and Figure 2C. Claim 44 defines forming a protrusion of a shape for forming at least one air gap between the scintillator material surfaces and the reflector. See page 23 lines 12-15 which describes the scintillator "… Held in position… by ribs or other

protrusions..” .See also figure 2C.

Grounds of rejection to be reviewed on appeal

Claims 1-7, 11-14, 17-21, 24, 29 and 32-52 are rejected under 35 USC 112 first paragraph as allegedly failing to comply with the enablement requirement.

Claims 1-7, 11-14, 17-21, 24, 29 and 32-52 stand rejected under 35 USC 112, first paragraph as allegedly failing to comply with the written description requirement.

Claim 44 stand rejected under 35 USC 112, second paragraph as allegedly being indefinite.

Claim 9 stands rejected under 35 USC 103 as being obvious over Freund in view of DiBianca and Skillicorn.

Claim 16 stands rejected under 35 USC 103 as being obvious over Freund in view of Okane and Hoffman.

Claims 22-23 stand rejected under 35 USC 103 as being obvious over Freund in view of DiBianca and Skillicorn and further in view of Difilippo.

Claims 25-26 stand rejected under 35 USC 103 as being obvious based on Freund in view of DiBianca and Skillicorn and in view of O'Kane.

Argument

Rejections Under 35 USC 112, first paragraph

Claims 1-7, 11-14, 17-21, 24, 29 and 32-52 stand rejected under 35 USC 112, first paragraph, as allegedly failing to comply with the enablement requirement and/or the written description requirement. This contention is respectfully traversed.

The rejection objects to certain claims such as claims 1 and 37 which refer to the "bridge" and other similar language or similar subject matter. However, this is clearly disclosed in paragraph 27 of the application, which refers to scintillator parts 202 which collectively form an array, and which are connected by "an exit window Bridge" spanning the gaps between the pixels 202. Paragraph 27, page 17 eighth line from the bottom, also refers to how these exit bridges may be formed of "scintillator material left uncut in the fabrication of the gaps". The rejection is correct that at least one disclosed embodiment requires that the exit window be removed at some point before the FINAL product has been produced. However, the intermediate product, that is the product that is intermediately formed when the scintillator array is put into place and before that exit window is removed, is certainly disclosed by the specification - see above. Also, see, for example, paragraph 28

explains how the pixels are inserted into the recess leaving the exit window bridge exposed. That intermediate product is clearly disclosed within the specification, and supports the subject matter of certain claims.

Other places within the specification describe how that exit window bridge holds that intermediate portion in place, see for example the mid-part of paragraph 27. Even if applicant is claiming the intermediate byproduct, it is still quite clear that the specification supports this intermediate product.

Rejections Under 35 USC 112, second paragraph

The rejection also rejects claim 44. The rejection alleges that the air gap causes the material to be separate from the surface.

However, the claim requires that the shape mates with the reflector, and that the "protrusion", which forms the air gap, is part of the reflector. Therefore, the reflector clearly does hold the scintillator material in place. Hence this claim is entirely consistent.

Rejections Based on 35 USC 103

Only claims 9, 16, 22, 23, 25 and 26 were rejected based on prior art. Presumably, therefore, the remaining claims 1-7, 11-

14, 17-21, 24, 29, and 32-52 should presumably be allowable over the cited prior art.

Claim 9 was rejected over Freund in view of DiBianca and Skillicorn. This contention is respectfully traversed. Claim 9 defines that the preformed reflector has inner surfaces that contain the scintillator material, and that a protrusion is formed as part of the inner surfaces of the preformed reflector that form a spacer to form the air gap.

That is, the air gap is automatically formed from a specified structure of the preformed reflector.

The rejection states that Freund shows the basic scintillator system, which could be modified by the secondary references. The rejection apparently reasons that DiBianca shows a system of using adhesive to produce an air gap, along with Skillcorn's alignment, makes obvious the claimed protrusion to form an air gap. However, this is respectfully suggested to be based on hindsight - not on the teaching of the combined references. In fact, neither DiBianca nor Skillicorn teaches anything about the claimed protrusion. The DiBianca teaching would require the EXTRA STEP of adding adhesive. No prior art teaches the simple technique of simply using a protrusion for this purpose.

The rejection cites both DiBianca and Skillicorn to show the air gaps. DiBianca teaches that an air gap may be useful in this kind of situation. Skillicorn teaches aligning the placement of scintillator elements using stretched wires. Skillicorn's stretched wires are not disclosed to have the purpose of forming an air-gap.

Therefore, the hypothetical combination of Freund with DiBianca with Skillicorn does not teach or suggest a protrusion formed of a spacer formed as part of the inner surfaces of the preformed reflector. DiBianca forms his air gap from adhesive material. This is entirely different from a reflector formed from a protrusion on the preformed reflector that allows an air gap. DiBianca would hence require the extra step of depositing that adhesive material in place to form the air gap.

In fact, claim 9, which defines a protrusion forming a spacer to form the air gap, is much simpler than DiBianca's system of using the adhesive to form the air gap. In contrast to DiBianca's necessity to add the adhesive as a separate step, claim 9 simply allows forming a protrusion which automatically forms an air gap. This is not suggested by any of the cited prior art, and provides a significant simplicity as compared therewith - that simplicity not being fairly expected from any of that prior art.

Claim 16 was rejected over Freund in view of O'Kane and further in view of Hoffman. However, nothing in the cited prior art teaches a preformed reflector with different materials of the scintillator formed of different materials. The final rejection ADMITS that Freund does not show this, see page 7, fifth line from the bottom. O'Kane is cited to show polyethylene, and does not show anything about scintillator pixels formed of different materials. In fact, while Hoffman discloses that different scintillator materials could be used for different purposes, he teaches nothing about using different materials within pixels of a preformed reflector, as claimed.**

Claims 22,23, 25, 26 depend from claim 9, and should be allowable for reasons stated above with respect to claim 9 as well as on their own merits.

For each of these reasons, all of the claims are in condition for patentability, and the rejection should be reversed.

Please charge any fees due in connection with this response, (other than any paid concurrently via EFS), to Deposit Account No. 50-4376, small entity.

Respectfully submitted,

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Claims appendix

1. A scintillator assembly, comprising:

an array of scintillator material comprising plural pixels of separated scintillator material, each having outer surfaces of a first shape, and a bridge formed of uncut scintillator material between said pixels, holding together the plural separated pixels in a specified geometry; and

a preformed reflector formed of polyethylene, further comprising titanium dioxide as an additive to said polyethylene, having plural inner surfaces which each mate with said array of plural separated pixels,

and wherein said bridge has specified surfaces between the pixels that hold said array of scintillator material of said array at least partly within said pre-formed reflector.

2. An assembly as in claim 1, wherein said preformed reflector is a two dimensional array of pixels of said scintillator material with said bridge being uncut scintillator material between the pixels that two-dimensionally holds the pixels together, and said surfaces of said uncut scintillator material forming said bridge two dimensionally holds said scintillator material within said preformed reflector.

3. An assembly as in claim 1, further comprising an adhesive material, bonding said scintillator material within said pre-formed reflector.

4. An assembly as in claim 2, further comprising ridges within said preformed reflector, holding said scintillator material within said preformed reflector.

5. An assembly as in claim 1, further comprising an opening in the preformed reflector, at a specified location, corresponding to a specified location on the scintillator material.

6. An assembly as in claim 5, wherein said opening is at a location of an exit window on the scintillator material.

7. An assembly as in claim 5, wherein said opening is at a location of a light guide input to or output from the scintillator material.

9. A scintillator assembly, comprising:

a scintillator material, having outer surfaces of a first

shape; and

a preformed reflector, having inner surfaces which mate with said first shape to contain said scintillator material at least partly within said pre-formed reflector, said reflector formed to leave at least one air gap between a wall of the reflector and a surface of the scintillator material, further comprising a protrusion formed as a part of said inner surfaces of said preformed reflector, said protrusion forming a spacer to form said air gap.

11. An assembly as in claim 1, further comprising a plurality of openings in the pre-formed reflector, at locations of a plurality of exit faces for the scintillator material.

12. An assembly as in claim 1, wherein the pre¬formed reflector is formed of multiple pieces.

13. The scintillator assembly of claim 1, in which said first shape has an exit window smaller than the area of a face of the pixel upon which said exit window is defined.

14. The scintillator assembly of claim 1, in which said first

shape is other than a rectangular parallelepiped.

16. A scintillator assembly, comprising:

an array of scintillator material comprising plural pixels of separated scintillator material, each having outer surfaces of a first shape, and a bridge, holding together the plural separated pixels in a specified geometry; and

a preformed reflector formed of polyethylene, having plural inner surfaces which each mate with said array of plural separated pixels, to contain each of said pixels of scintillator material of said array at least partly within said pre-formed reflector, at least one scintillator pixels of said array comprises at least one material differing from a second material of another scintillator pixels.

17. The scintillator assembly of claim 1, in which said first shape forms a tapered end part that is tapered in two separate directions, and mates with, and is held in place by, corresponding surfaces on said preformed reflector, where said taper causes said shape to vary in cross¬sectional area in two directions.

18. The scintillator assembly of claim 1, in which said scintillator materials has at least one exit face that is not perpendicular to adjacent sidewalls of the material.

19. The scintillator assembly of Claim 1, in which said preformed reflector is sufficiently flexible to permit insertion of said scintillator material by press fitting.

20. The scintillator assembly of claim 1, further comprising at least one optical fiber inserted into said scintillator material.

21. The scintillator assembly of claim 20, in which said optical fiber is used for wavelength shifting.

22. The scintillator assembly of claim 9, further comprising at least one optical fiber inserted into or passing through said at least one air gap between one or a plurality of said units and said reflector.

23. The scintillator assembly of claim 22, in which said at least one optical fiber is used for wavelength shifting.

24. The scintillator assembly of claim 1, further comprising a scintillator material as an additive to the reflector material of said preformed reflector.

25. A scintillator assembly of claim 9, wherein the reflector is formed of polyethylene with a titanium dioxide additive.

26. The scintillator assembly of claim 9, wherein the reflector is formed of polyethylene.

29. The scintillator assembly of claim 1, in which one or a plurality of organic optical brightening agents is an additive to the polyethylene reflector.

32. The scintillator assembly of claim 1, in which at least one of aluminum oxide, aluminum orthophosphate, antimony trioxide, antimony tetroxide, barium oxide, barium carbonate, barium molybdate, bismuth oxybromide, bismuth oxychloride, bismuth oxyfluoride, calcium aluminate, calcium hydride, calcium peroxide, calcium trialuminate, calcium triorthophoshate,

calcium tungstate, hafnium oxide, lanthanum oxide, magnesium carbonate, magnesium oxide, strontium peroxide, tin dichloride, zinc oxide, zirconium tetrachloride, and zirconium tetraflouride is an additive to said pre-formed reflector.

33. The scintillator assembly of claim 1, in which one or a plurality of high-Z, high-density materials from the group consisting of bismuth, bismuth oxychloride, bismuth oxyflouride, gold, hafnium, hafnium oxide, iridium, lanthanum, lanthanum oxide, lead, lead oxide, osmium, platinum, platinum phosphide, rhenium, tantalum, tungsten, and other inorganic compounds of heavy metals is an additive to the reflector assembly of a pre-formed said pre-formed reflector.

34. The scintillator assembly of claim 1, in which one or a plurality of scintillating materials from the group consisting of barium fluoride, cerium-activated bismuth germanium oxide (EGO), cadmium tungstate, sodium-doped cesium iodide, thallium-doped cesium iodide, cerium fluoride, europium-doped calcium fluoride, terbium-activated glass, europium-doped lithium, cerium-activated lithium glass, cerium-activated gadolinium silicate (GSO), lanthanum bromide, lanthanum chloride, thallium-doped sodium iodide, cerium-activated yttrium aluminum garnet

(YAG), cerium-activated yttrium aluminum perovskite (YAP), cerium-activated lutetium orthoaluminate (LuAP), cerium-activated lutetium orthosilicate (LSO) and organic scintillators is an additive to said pre-formed reflector.

35. The scintillator assembly of claim 1, in which one or a plurality of organic optical brightening agents is an additive to the reflector assembly of a said pre-formed reflector.

36. The scintillator assembly of claim 1, in which said preformed reflector is formed by injection molding.

37. A method, comprising:

pre-forming a reflector array having plural individual pixels from polyethylene, each of a specified shape having specified shaped inner surfaces; and

attaching said reflector to an array of scintillator material formed of separated pixels of scintillator material that define a two-dimensional array, and that are held together by a bridging portion between individual elements of said two-dimensional array, said bridging portion formed of uncut scintillator material, each of said separated pixels shaped to

fit within one of said individual pixels of said reflector array, and wherein said attaching comprises holding said two dimensional array to said reflector using said bridging portion that is between said separated pixels to hold each of said pixels relative to said reflector, and wherein said bridging portion has specified surfaces that hold said array two dimensionally within said pre-formed reflector.

38. A method as in claim 37, wherein said attaching comprises using pressure of an outer surface of said scintillator material against a pressure of an inner surface of said reflector to hold said scintillator material within said reflector.

39. A method as in claim 37, further comprising attaching said scintillator material to said reflector by an adhesive.

40. A method as in claim 37, wherein said pre-forming step comprises pre-forming a reflector having at least one opening therein.

41. A method as in claim 40, wherein said at least one opening mates with an exit window on the scintillator material.

42. A method as in claim 40, wherein said at least one opening includes a light guide input to or output from the scintillator material.

43. A method as in claim 37, wherein said reflector has a specified shape to hold said separated pixels of said scintillator material.

44. A method, comprising:

pre-forming a reflector of a specified shape having specified shaped inner surfaces, in which said specified shape forms a tapered end part that is tapered in two separate directions;

attaching said reflector to a scintillator material of a shape that fits within said inner surfaces, wherein said shape mates with, and is held in place by, corresponding surfaces on said preformed reflector, where said taper causes said shape to vary in cross-sectional area in two directions; and

performing a protrusion on at least one of said inner surfaces of said reflector for forming at least one air gap between adjacent scintillator material surfaces and the reflector.

45. An assembly as in claim 1, wherein said preformed reflector has a plurality of continuous surfaces which extend from a first portion on the scintillator material near a first end thereof, to a second portion on the scintillator material near a second opposite end thereof, and continuously extends between said first and second portions.

46. A method as in claim 37, further comprising using said reflector to reflect scintillation photons back into said scintillator material.

47. A method as in claim 37, wherein said forming a reflector comprises forming a plurality of continuous surfaces which extend from a first portion on the scintillator material near a first end thereof to a second portion on the scintillator material near a second opposite end thereof, and continuously extending between said first and second portions.

48. An assembly as in claim 1, wherein said array of scintillator material which is held together by said bridge is a two-dimensional array.

49. An assembly as in claim 48 wherein said array is a 4x4

array of scintillator material.

50. An assembly as in claim 13, wherein said first shape has a first portion at one end which is substantially constant and rectangular in cross section, and has a second end which reduces in area between said substantially constant cross-section and an end section which forms an exit window of the scintillator material and forms a tapered end part that is tapered in two separate directions, and mates with, and is held in place by, corresponding surfaces on said preformed reflector, where said taper causes said shape to vary.

51. An assembly as in claim 1, wherein said preformed reflector has, for each pixel, four completely solid walls, completely surrounding walls of said separated pixel.

52. A method as in claim 37, wherein said array of scintillator material is a two-dimensional array.

Evidence appendix

None

Related proceedings appendix

None